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BY PROFESSOR T. G. BONNEY, MISS C. A. RAISIN, AND  
SIR J. B. STONE.

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#### CONTRIBUTIONS (GEOLOGICAL) TO BOOKS PUBLISHED BY OTHERS.

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E. Fitzgerald, "Climbs in the New Zealand Alps," 1896: pp. 337-339.

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## II.—PRELIMINARY NOTE ON SOME RECENTLY DISCOVERED EXTINCT VERTEBRATES FROM EGYPT. (PART I.)

By CHAS. W. ANDREWS, D.Sc., F.G.S., British Museum (Nat. Hist.).

**D**URING a recent visit to Egypt, through the kindness of Captain H. G. Lyons, Director-General of the Egyptian Survey, I have on several occasions had opportunities of accompanying members of the Staff of the Geological Survey on collecting expeditions into the Western Desert.

On one of these journeys I accompanied Mr. H. J. L. Beadnell, F.G.S., to the Fayûm, and we took the opportunity of examining the escarpments of Upper Eocene and Oligocene age in a locality from which Mr. Beadnell had previously obtained some remains of Zeuglodonts and Sirenians. On our first visit it was not until we were about to return to Cairo that any finds of importance were made, but on the last day of our stay a number of interesting specimens were found, including portions of the skeletons of a Sirenian (probably *Eotherium aegyptiacum*, Owen),<sup>1</sup> of *Zeuglodon* (? *Z. Osiris*, Dames),<sup>2</sup> and of a small ungulate, as well as remains of reptiles (*Crocodylia*, *Chelonia*, and *Ophidia*). On our return to Cairo it was arranged to go back to this rich locality and make as extensive collections as possible. The results of this second visit were very satisfactory, and a number of interesting specimens were obtained.

The beds from which the remains were collected are, in Mr. Beadnell's opinion, probably of Upper Eocene and Lower Oligocene

<sup>1</sup> Owen, "On Fossil Evidences of a Sirenian Mammal (*Eotherium aegyptiacum*, Owen) from the Nummulitic Eocene of the Mokattam Cliffs, near Cairo": *Quart. Journ. Geol. Soc.*, vol. xxxi (1875), p. 100, pl. iii.

<sup>2</sup> Dames, "Ueber Zeuglodonten aus Aegypten und die Beziehungen der Archaeoceten zu den Uebrigen Cetaceen": *Palacont. Abhand., neue Folge*, Bd. i (1894), p. 189.

age. In the present paper, merely very brief notices of some of the more important new forms are given, but subsequently it is intended by Captain Lyons to publish as complete an account as possible of the geology and physical geography of the district, prepared by Mr. Beadnell, with detailed descriptions of the fossil vertebrata by the present writer.

MAMMALIA.

The mammalian remains obtained include a Sirenian probably identical with *Eotherium ægyptiacum* from the Mokattam Hills, described by Owen on the evidence of a brain-cast only; *Zeuglodon*, including apparently Dames' *Z. Osiris*, and perhaps a second species; and, lastly, several ungulates which are new to science, and are the subjects of the following notices.

*Palæomastodon Beadnelli*,<sup>1</sup> Andrews. (Fig. 1.)

One of the most important specimens found in the higher beds (probably Lower Oligocene) is the nearly complete left ramus of the mandible of a Proboscidean, which is in many respects similar to that of *Mastodon angustidens*, but belonged to a much smaller and in

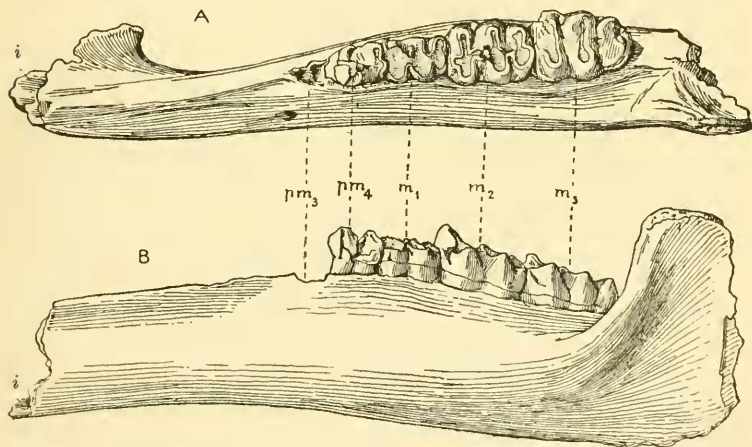


FIG. 1.—Left ramus of mandible of *Palæomastodon Beadnelli*. One-sixth natural size. (A) From above; (B) outer surface.

several respects more generalized form. Remains of *M. angustidens* (or a very closely allied form)<sup>2</sup> were found by Mr. T. Barron and

<sup>1</sup> "Tageblatt des V Internationalen Zoologen-Congresses," Berlin, No. 6, August 16th, 1901, p. 4.

<sup>2</sup> Remains of a small *Mastodon* from the Lower Miocene (Cartennien) near Isserville (Kabylie), Algiers, have been described by Depéret (Bull. Soc. Géol. France, sér. III, tom. xxv, 1897, p. 518) under the name *Mastodon angustidens*, var. *pygmæus*. The teeth from Moghara, though slightly smaller than specimens from Sansan, are not sufficiently so to justify their reference to this small variety. Moreover, there seems to have been little or no cement in the valleys of these teeth, while in Depéret's specimen it was abundant.

myself in Lower Miocene at Moghara, to the north-west of the present locality, and it seems probable that this mandible may have belonged to an ancestor of that well-known Miocene species.

The mandibular ramus (Fig. 1) is long and relatively narrow from above downwards, and is very slightly decurved anteriorly. It is chiefly remarkable for the elongation of the edentulous region in front of the cheek-teeth; in this region the alveolar border forms a sharp edge without trace of tooth sockets. The symphysis commences about 12 cm. in front of the anterior premolar, but its length cannot be determined, as the anterior portion of the jaw is broken away. Judging, however, by the large size of the central canal at the broken end, it seems probable that the symphysis was considerably elongated, though possibly not to the same extent as in *M. angustidens*. The base of an alveolus for a tusk (Fig. 1, *i*) is preserved on the broken end.

The coronoid process rises from the outer surface opposite the posterior third of the last molar; but its upper part is broken away, as also are the condyle and the angle. The cheek-teeth are distinctly proboscidian, and the molars are very similar to the anterior molars of some Mastodons. There were originally five teeth *in situ*, but the anterior one (pm. 3) has fallen out of its socket, the form of which indicates that this tooth had two roots, a smaller anterior and a larger posterior; probably the crown was triangular in outline. The next tooth (pm. 4) is much broken; it seems to have consisted of a high anterior ridge, a median transverse crest, only traces of which remain, and a small posterior ridge now much worn. The next tooth (m. 1) is likewise trilophodont, the hinder crest being much the smallest. It is much worn and considerably broken on the inner side. The succeeding molars are in an excellent state of preservation. Both are trilophodont, but in the last the hinder ridge (talon) is considerably larger than in m. 2. Each transverse ridge is evidently composed of two tubercles, and is connected with the ridge behind by a very slightly developed longitudinal prominence. Small tubercles occur at the inner ends of the transverse valleys in m. 3. The outer ends of the ridges are far more worn than the inner, which stand up considerably above the rest of the tooth-crown. There is a regular increase in the degree of wear from m. 3 to m. 1. It seemed just possible that the tooth here described as m. 1 might be the last milk-molar, but its state of wear compared with that of the other teeth, and the absence of any trace of a premolar germ in the jaw beneath it or of a molar behind those now described, prove that the interpretation here adopted is the correct one.

It will be seen that this genus differs from *Mastodon* in the greater simplicity of m. 3, and in the fact that two premolars and three molars are in use at once. I propose the generic name *Palæomastodon* for this form, the name of the species being *P. Beadnelli* after Mr. H. J. L. Beadnell, of the Egyptian Geological Survey, to whom the discovery of these fossils is mainly due and by whom the survey of the Fayûm area has been carried out.

The dimensions of the specimen figured are as follows:—

Total length of specimen	...	...	...	...	610
Depth of ramus in middle of diastema	...	...	...	...	96
”	”	immediately in front of p.m. 3	...	...	105
”	”	immediately beneath p.m. 4	...	...	120
”	”	at symphysis	...	...	97

DIMENSIONS OF TEETH (in millimetres).

		Length.	Width.
p.m. 3	...	41 (of alveolus)	—
p.m. 4	...	48	33 (approx.)
m. 1	...	48	37 (approx.)
m. 2	...	65	51
m. 3	...	78	53

Approximate length of molar and premolar series ... 285 mm.

Other specimens probably referable to this form are a maxilla with two molars, a nearly perfect specimen of m. 2, a scapula, a humerus, a femur, a tibia, an imperfect os innominatum, an atlas, and an axis.

*Mœritherium Lyonsi*,<sup>1</sup> Andrews. (Fig. 2.)

In the lower beds of probably Upper Eocene age a great quantity of remains of an ungulate about the size of a large tapir was obtained. These include numerous portions of the skull and mandible, some with the teeth in good preservation, associated sets of vertebrae more or less complete, ossa innominata, femora, humeri, etc. From these it will eventually be possible to obtain a very good idea of the skeletal structure of this animal. Here it will only be possible to refer briefly to the skull and teeth.

The skull is very massively built. The cranial region is depressed, and the stout zygomatic process arises far back and projects strongly outward. The external auditory opening is on the upper surface of the base of this process, and is bordered posteriorly by an outgrowth of the squamosal which grows round it as in the elephants. The brain-case is relatively large. The orbit is small, and the nasals seem to have been rather short, leaving a large narial aperture.

The teeth are remarkable. In the upper jaw the median pair of incisors are small, the second pair greatly enlarged, triangular in section, and form a strong pair of downwardly directed tusks

<sup>1</sup> "Tageblatt des V Internationalen Zoologen-Congresses," Berlin, No. 6, August 16th, 1901, p. 4. The generic name refers to the fact that the remains of the animal were found near the bed of the ancient Lake Mœris. The species is named after Captain Lyons, Director-General of the Egyptian Geological Survey.

Schweinfurth, in his account of the Fayum (*Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, 1886, Bd. xxi, p. 139), states that in a hill about 12½ miles west from the temple discovered by him he collected a jaw of *Zeuglodon* and two mandibular rami of a creature resembling a pig or tapir and corresponding in many respects to *Charopotamus*. These specimens were afterwards described by Dames, who (*loc. cit. supra*) states that the so-called *Charopotamus* jaws are in fact the anterior ends of mandibles of *Zeuglodon*. It seems not improbable, however, that Schweinfurth was more nearly right, and that the specimens actually belonged to the present species. A further examination of these specimens is desirable.



(Fig. 2B). Immediately behind the large incisor are two small teeth (represented only by alveoli), the anterior one probably being the third incisor, the posterior the canine; behind this is a diastema of some length (about 27 mm.). (Fig. 2A.)

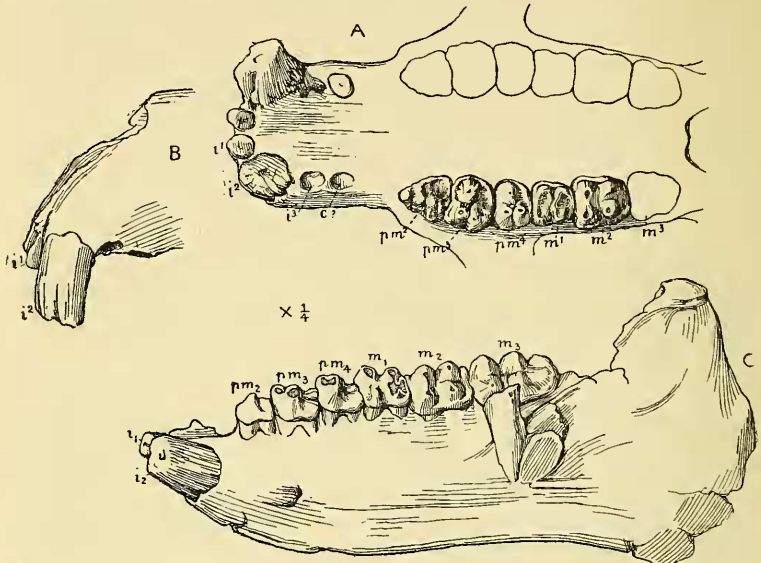


FIG. 2.—Dentition of *Maritherium Lyonsi*. One-fourth natural size. (A) Upper teeth; (B) front of snout, showing the tusk-like second incisors; (C) left ramus of mandible from outer side.

The cheek-teeth are six in number. The anterior premolar (pm. 2) consists of an outer wall composed of four blunt tubercles, of which the middle two (protocone and tritocone of Scott's nomenclature) are largest and subequal. The anterior (? parastyle) and posterior (? metastyle) are smaller. The inner side of the tooth forms a broad triangular shelf-like edge, worn into a concavity by the tooth below. The next tooth (pm. 3) has two external tubercles (proto- and tritocone) and a large inner tubercle (deuterocone). The cingulum is well developed, and forms a shelf-like hollow on the posterior border. The next tooth (pm. 4) is similar. The first molar is bilophodont, but the crests, which are completely separated by the transverse valley, are distinctly composed of two tubercles, those forming the anterior one being the paracone and protocone, those in the posterior the metacone and hypocone. The cingulum is well developed on the inner and anterior border of the tooth, less distinct on the posterior, and absent on the exterior border. The next tooth (m. 2) is similar, the last is wanting in the specimen described.

The mandible is very solidly constructed, the rami being thickened and very convex from above downward on the outer

surface. The symphyisial region is massive and spout-like. The dental foramen is beneath pm. 3. The coronoid process arises from the outer surface of the ramus beneath the anterior end of m. 3, and has a thickened anterior border which often remains when the rest is broken away (see Fig. 2c). The condyle is transversely extended, and is convex in that direction as well as from before backward.

There are two pairs of lower incisors, the first being comparatively small teeth crowded between the second pair, which are modified to form large tusks and are triangular in section. The incisors are procumbent.

The first of the cheek-teeth (pm. 2) consists of a high, blunt anterior cusp, and a low, broad shelf-like talon. The next (pm. 3) has a high anterior crest which seems to be composed of at least two united cusps, and in front of the ridge thus formed there is a small antero-internal cusp. Behind there is a talon with a slight median prominence. The next tooth (pm. 4) is similar, and is, therefore, simpler than the succeeding first molar, which is bilophodont, each ridge being evidently composed of two tubercles. On the outer side there is a distinct cingulum, which on the hinder border of the tooth broadens out into a narrow talon with a median tubercle forming a small third lobe to the tooth. The next tooth (m. 2) is similar, but the talon is larger. In the last molar the talon is large and bears a transversely elongated cusp on its postero-internal border.

The molars show a strong tendency to assume a trilophodont form ; in fact, the two last may almost be regarded as having already done so. This circumstance, together with the fact that in both jaws the second incisors are enormously enlarged, while at the same time there is a tendency to suppress the others (the third lower having already disappeared), incline me to believe that in this animal we have a generalized forerunner of the Mastodon type of Proboscidean. This conclusion is likewise supported by some points in the structure of the skull and skeleton. As to the group of primitive mammals to which *Mærittherium* is most nearly related, it is not possible to arrive at any definite conclusion till all the available parts of the skeleton have been examined, but perhaps it will be found to have arisen from some, at present, unknown subdivision of the Amblypoda.

DIMENSIONS OF UPPER DENTITION. (FIGS. 2A and B.)

Approximate length of upper pm. and m. series	...	147 mm.
Approximate diameter of tusk	... ..	30 "
Length of diastema	... ..	27 "

DIMENSIONS OF UPPER CHEEK TEETH.

		Length.	Width.
pm. 2	... ..	27 mm.	23 mm. (approx.)
pm. 3	... ..	26.5 "	29.5 "
pm. 4	... ..	23 "	27.5 "
m. 1	... ..	29 "	27 "
m. 2	... ..	26 "	23.5 "
m. 3	... ..		

DIMENSIONS OF THE MANDIBLE AND LOWER DENTITION SHOWN IN FIG. 2C.

Total length	...	...	...	...	...	320 mm.
Height of condyle above inferior border	...	...	...	...	...	153 "
Length of premolar and molar	...	...	...	...	...	172 "
				Length.		Width.
pm. 2	...	...	22	mm.	...	16 mm.
pm. 3	...	...	23	"	...	21 "
pm. 4	...	...	25	"	...	23 "
m. 1	...	...	26.5	"	...	24.5 "
m. 2	...	...	35	"	...	30 "
m. 3	...	...	42	"	...	30 "

A large part of the skeleton of this animal is known, and will be described in the detailed account of these specimens. Here we may

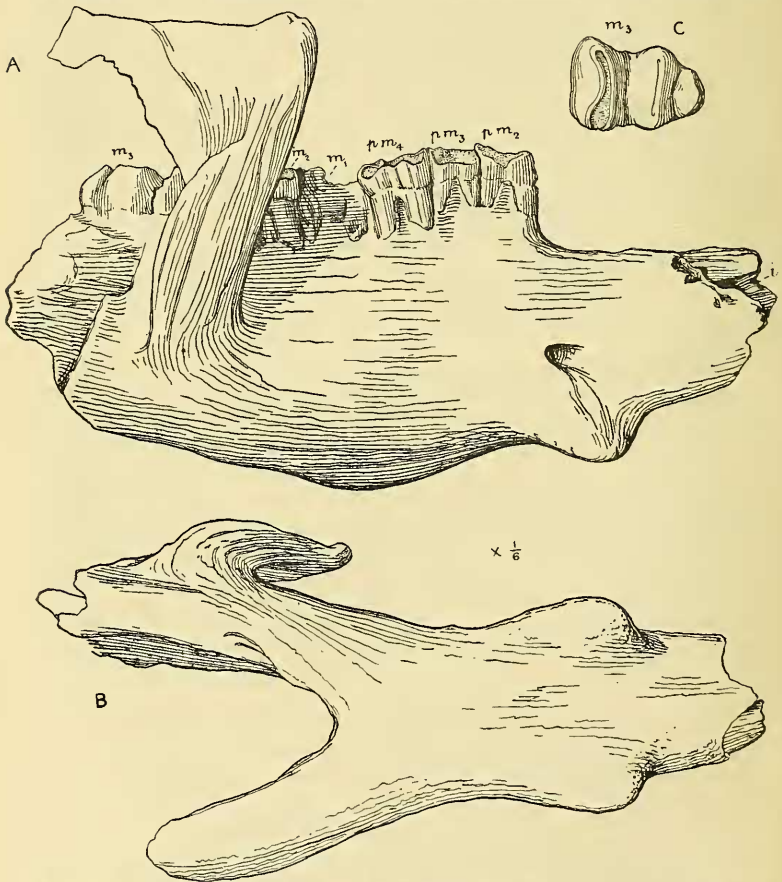


FIG. 3.—Mandible and lower teeth of *Bradytherium grave*. One-sixth natural size. (A) Right ramus of mandible from outer side; (B) mandible from below; (C) third left lower molar.

merely mention that the femur is without third trochanter, and the humerus has no entipcondylar foramen.

*Bradytherium grave*,<sup>1</sup> Andrews. (Figs. 3 and 4.)

Another very remarkable animal from the lower beds is an enormously heavily built ungulate, which in many respects resembles *Dinotherium*, but in others reminds one of some of the gigantic Amblypoda of North America.

The mandible is shown in Fig. 3A and B. It will be seen that it is a very massive structure. Its inferior border beneath the molar series is convex, and immediately beneath the front of the anterior premolar it bears a stout tuberosity which is directed outward, downward, and forward, and is somewhat similar to the protuberances occurring in the same place in some Dinocerata. In front of this process the lower border of the jaw slopes upward, and forms the floor of the socket for the large tusk-like procumbent incisors. The dental foramen is situated beneath the anterior premolar, and there seem to be two smaller foramina farther back. The coronoid process rises from the middle of the ramus at the level of m. 2. Its greatly thickened border slopes somewhat forward, and rises some 11 cm. above the crowns of the teeth. It then turns back at right angles, but is broken away posteriorly, as also are both the condylar and angular regions. The symphysis is very long (Fig. 3B), commencing beneath m. 1; its upper surface is spout-like and narrows rapidly anteriorly, so that the anterior premolars are only about 5 or 6 cm. apart. In front the pair of large tusk-like incisors are almost in contact in the middle line.

As just mentioned, there was a pair of large tusks, procumbent in position, and close together in the middle line. In this specimen the broken base of the tooth is *in situ* on the left side, while on the right the alveolus is empty. It is possible that there may have been a second pair of small incisors above the large ones, but the evidence of this is not clear. Behind the incisors is a diastema of about 13 cm. The portion of the alveolar border bearing the cheek-teeth is raised considerably above the diastema. There were three premolars, of which the anterior one (p.m. 2) has a triangular crown; it appears to have three roots, of which one is anterior, the other two arranged transversely posteriorly. The next two (pm. 3 and pm. 4) have quadrate crowns, apparently bilophodont, and four roots. The first molar is greatly broken; it had four roots. The second is bilophodont, and the crown is somewhat longer than broad; there are four roots. The last (Fig. 3c) consists of two transverse crests and a large talon: in this also there seem to have been only four roots, the postero-external one being enlarged to support the talon. All these teeth are greatly worn, especially on the outer side. They are also greatly damaged by exposure to drifting sand. The upper cheek-teeth are also much damaged: those of the left side are shown in Fig. 4. The anterior premolar (pm. 2) is broken on its inner side: it seems to have had three roots, and its crown narrowed considerably in front. pm. 3 and pm. 4 are both four-rooted, and their

<sup>1</sup> "Tageblatt des V Internationalen Zoologen-Congresses," Berlin, No. 6, August 16th, 1901, p. 4.



rectangular crowns are wider transversely than from before backward. Their surface is greatly worn, so that no trace of cusps or ridges remains. The greatly worn m. 1 is similar. m. 2 and m. 3 have quadrate crowns, each composed of a pair of transverse ridges, which are much more worn on the inner than on the outer sides.

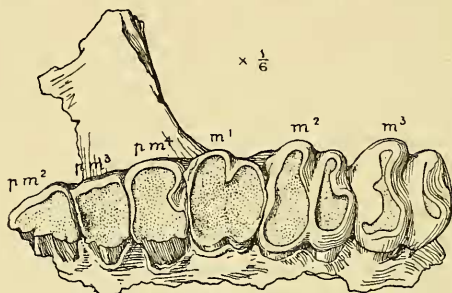


FIG. 4.—Left upper cheek-teeth of *Braditherium grave*, Andrews.  
One-sixth natural size.

Besides the mandible and upper teeth here described the collection includes the scapula, humerus, ulna, and some other portions of the skeleton.

The humerus is enormously stout, and its distal end greatly expanded.

This remarkable animal, for which the name *Braditherium grave* is proposed, in many respects resembles *Dinotherium*, at least as far as its dentition goes, but differs in several points, e.g. in the presence of three premolars and in the existence of a talon on the third lower molar. In some ways, as in the presence of the tuberosity on the lower border of the mandible and in the form of the humerus, it shows some similarity to certain of the Dinocerata. Its actual position remains for the present doubtful. Portions of three individuals were found, so that there is every reason to hope that further search may yield more material for settling this question.

The dimensions of the specimens described and figured are (in millimetres):—

	Length.	Width.
UPPER TEETH.—pm. 2	57	57
pm. 3	39	65
pm. 4	50	80
m. 1	59	84
m. 2	75	86
m. 3	83	87
LOWER TEETH.—pm. 2	51	35 (approx.)
pm. 3	43	47
pm. 4	57	55
m. 1	57	—
m. 2	86	64
m. 3	105	70

Total length of upper molar and premolar series	365
Total length of lower molar and premolar series (approx.)	385
Total length of mandible as figured	660
Depth of ramus beneath pm. 4, about	256

mm.

The discovery of these Lower Tertiary mammals is of considerable importance, not merely on account of the interest of the specimens hitherto collected, but as showing that much may be expected from further investigation of the Tertiary deposits of the Libyan Desert. At present I am acquainted with (probably) Upper Eocene, Lower Oligocene, Lower Miocene, and Lower Pliocene mammal-bearing beds; and in several localities, during journeys across the desert, fragments of teeth and bones were observed when it was impossible to stay to make any search after more complete specimens, which must no doubt be obtainable. Another point of importance is that the fauna now described differs entirely from that found in deposits of the same age in Europe, and points to the existence of a large land area to the south which had long been isolated. The few species so far obtained can only represent a very small fraction of those which existed, and when found will throw great light on many obscure questions of geographical distribution. One long-standing problem, viz. the place of origin of the Proboscidea, may perhaps be regarded as solved already.

III.—NOTE ON THE DISCOVERY OF A VERY FINE EXAMPLE OF  
*PLEUROTOMA PRISCA*, SOLANDER, SP. (1766), AT BARTON, HANTS.

By HENRY WOODWARD, LL.D., F.R.S., V.P.Z.S., F.G.S.

IN one of his recent visits to the Natural History Museum, Major C. E. Beadnell kindly showed me a fine example of the well-known shell *Pleurotoma prisca*, which had been obtained some years ago by his son, Mr. Hugh J. L. Beadnell, F.G.S. (now of the Geological Survey of Egypt), when collecting specimens from the Barton Clay (Middle Eocene) in the historical cliffs at Barton, Hampshire, whence, prior to 1766, Gustavus Brander, F.R.S., made his famous collection, some of the specimens of which are still preserved in the British Museum (Natural History).<sup>1</sup>

On comparing this shell with the figures in F. E. Edwards' & S. V. Wood's "Eocene Mollusca" (Pal. Soc. Mon.), tab. xxxiii, figs. 1a-e, I was surprised to find Mr. Beadnell's specimen greatly exceeded the figured examples in altitude of the spire, as well as in diameter. I therefore requested Major Beadnell to allow me to figure it, to which he at once most obligingly consented.

The following is a transcript of Edwards' & Searles Wood's description of *Pleurotoma prisca*,<sup>2</sup> Solander, sp. (1766).

"Shell elongated, fusiform, nearly smooth; the spire almost conical, pointed and moderately elevated, being of equal length with the aperture. The whorls are slightly ventricose; when young, the whole surface is covered with moderately distant, concentric, raised lines, in which state it resembles *Pl. filosa*, Lamk.; these lines, however, are lost on the fourth or fifth volution, and the whorls afterwards become smooth and shining, except at the base and over

<sup>1</sup> Figured and described by Dr. Solander in a work entitled "Fossilia Hantoniensia Collecta, et in Museo Britannico deposita, a Gustavo Brander, 1766."

<sup>2</sup> *Murex prisca*, Brander's Foss. Hant., 1766, p. 16, pl. i, fig. 25; pl. iii, fig. 44.